

New Hampshire Volunteer Lake Assessment Program

2003 Interim Report for Blaisdell Lake Sutton



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Water Division
Watershed Management Bureau
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OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **BLAISDELL LAKE, SUTTON**, the program coordinators have made the following observations and recommendations:

Thank you for your continued hard work sampling the lake this season! Your monitoring group sampled **four** times this season and has done so for many years! As you know, with multiple sampling events each season, we will be able to more accurately detect changes in water quality. Keep up the good work!

FIGURE INTERPRETATION

- **Figure 1 and Table 1:** The graphs in Figure 1 (Appendix A) show the historical and current year chlorophyll-a concentration in the water column. Table 1 (Appendix B) lists the maximum, minimum, and mean concentration for each sampling season that the lake has been monitored through the program.

Chlorophyll-a, a pigment naturally found in plants, is an indicator of the algal abundance. Because algae are usually microscopic plants that contain chlorophyll-a, and are naturally found in lake ecosystems, the chlorophyll-a concentration measured in the water gives an estimation of the algal concentration or lake productivity. **The mean (average) summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 7.02 ug/L.**

The current year data (the top graph) show that the chlorophyll-a concentration **increased greatly** from July 1 to July 29, and then **decreased** from July 29 to August 26. The chlorophyll-a concentration on July 1 and on August 26 was **less than** the state mean, while the chlorophyll-a concentration on July 29 was **greater than** the state median.

The historical data (the bottom graph) show that the 2003 chlorophyll-a mean is **approximately equal to** the state mean.

Overall, visual inspection of the historical data trend line (the bottom graph) shows **a variable, but overall slightly increasing** in-lake chlorophyll-a trend, meaning that the concentration has **fluctuated, but overall slightly worsened** since monitoring began. In the 2004 annual report, we will again be able to conduct a statistical analysis of the historic data to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration since monitoring began.

- **Figure 2 and Table 3:** The graphs in Figure 2 (Appendix A) show historical and current year data for lake transparency. Table 3 (Appendix B) lists the maximum, minimum and mean transparency data for each sampling season that the lake has been monitored through the program.

Volunteer monitors use the Secchi-disk, a 20 cm disk with alternating black and white quadrants, to measure water clarity (how far a person can see into the water). Transparency, a measure of water clarity, can be affected by the amount of algae and sediment from erosion, as well as the natural colors of the water. **The mean (average) summer transparency for New Hampshire's lakes and ponds is 3.7 meters.**

The current year data (the top graph) show that the in-lake transparency **remained relatively stable** from May 27 to July 1, **increased** from July 1 to July 29, and then **decreased** from July 29 to August 26. The transparency on each sampling event was **greater than** the state mean.

Overall, visual inspection of the historical data trend line (the bottom graph) shows **a stable** trend for in-lake transparency, meaning that the transparency has **remained approximately the same** since monitoring began. After 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historic data to objectively determine if there has been a significant change in the annual mean transparency since monitoring began.

Typically, high intensity rainfall causes erosion of sediments into lakes and streams, thus decreasing clarity. Efforts should continually be made to stabilize stream banks, lake shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the lake. Guides to Best Management Practices designed to reduce, and possibly even eliminate, nonpoint source pollutants, such as sediment loading, are available from DES upon request.

- **Figure 3 and Table 8:** The graphs in Figure 3 (Appendix A) show the amounts of phosphorus in the epilimnion (the upper layer) and the hypolimnion (the lower layer); the inset graphs show current year data. Table 8 (Appendix B) lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the lake has joined the program.

Phosphorus is the limiting nutrient for plant and algae growth in New Hampshire's freshwater lakes and ponds. Too much phosphorus in a lake can lead to increases in plant and algal growth over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 11 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration **remained relatively stable** (ranging from 6 to 8 ug/L) during all sampling events this season. The phosphorus concentration on each sampling event was **less than** the state median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration **increased** from May 27 to July 29, and then **decreased** from July 29 to August 26. The phosphorus concentration on May 27 was **less** than the state median, while the phosphorus concentration on July 1, July 29, and August 26 was **greater than** the state median.

The historical data show that the 2003 mean hypolimnetic phosphorus concentration is **greater than** the state median.

Overall, visual inspection of the historical data trend line for the epilimnion show a **slightly declining** phosphorus trend, which means that the concentration has **slightly improved** in the epilimnion since monitoring began.

Overall, visual inspection of the historical data trend line for the hypolimnion shows **variable, but overall stable** phosphorus trend, which means that the concentration has **fluctuated, but has not continually increased or decreased** in the hypolimnion since monitoring began.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about its sources and how excessive amounts can adversely impact the ecology and value of lakes and ponds. Phosphorus sources within a lake or pond's watershed typically include septic systems, animal

waste, lawn fertilizer, road and construction erosion, and natural wetlands.

TABLE INTERPRETATION

➤ **Table 2: Phytoplankton**

Table 2 (Appendix B) lists the current and historic phytoplankton species observed in the lake. The dominant phytoplankton species observed this year were ***Chrysosphaerella* (golden-brown), *Dinobryon* (golden-brown), and *Rhizosolenia* (diatom).**

Phytoplankton populations undergo a natural succession during the growing season (Please refer to the “Biological Monitoring Parameters” section of this report for a more detailed explanation regarding seasonal plankton succession). Diatoms and golden-brown algae are typical in New Hampshire’s less productive lakes and ponds.

➤ **Table 4: pH**

Table 4 (Appendix B) presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 5.5 severely limits the growth and reproduction of fish. A pH between 6.5 and 7.0 is ideal for fish. The mean pH value for the epilimnion (upper layer) in New Hampshire’s lakes and ponds is **6.5**, which indicates that the surface waters in state are slightly acidic. For a more detailed explanation regarding pH, please refer to the “Chemical Monitoring Parameters” section of this report.

The mean pH at the deep spot this season ranged from **6.21** in the hypolimnion to **6.82** in the epilimnion, which means that the water is ***slightly acidic***.

Due to the presence of granite bedrock in the state and the deposition of acid rain, there is not much that can be done to effectively increase lake pH.

➤ **Table 5: Acid Neutralizing Capacity**

Table 5 (Appendix B) presents the current year and historic epilimnetic ANC for each year the lake has been monitored through VLAP.

Buffering capacity or ANC describes the ability of a solution to resist changes in pH by neutralizing the acidic input to the lake. The mean ANC value for New Hampshire's lakes and ponds is **6.7 mg/L**, which indicates that many lakes and ponds in the state are "highly sensitive" to acidic inputs. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The Acid Neutralizing Capacity (ANC) of the epilimnion (the upper layer) continues to remain **slightly less than** the state mean.

➤ **Table 6: Conductivity**

Table 6 (Appendix B) presents the current and historic conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current. The mean conductivity value for New Hampshire's lakes and ponds is **62.1 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The conductivity has **increased** in the lake and most of the inlets since monitoring began. In addition, the in-lake conductivity is **greater than** the state mean. Typically, sources of increased conductivity are due to human activity. These activities include septic systems that fail and leak leachate into the groundwater (and eventually into the tributaries and the lake), agricultural runoff, and road runoff (which contains road salt during the spring snow melt). New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could contribute to increasing conductivity. In addition, natural sources, such as iron deposits in bedrock, can influence conductivity.

We recommend that your monitoring group conduct stream surveys and storm event sampling along the inlets with elevated conductivity, particularly **Russell Inlet**, so that we can determine what may be causing the increases.

For a detailed explanation on how to conduct rain event and stream surveys, please refer to the 2002 VLAP Annual Report "Special Topic Article", or contact the VLAP Coordinator.

➤ **Table 8: Total Phosphorus**

Table 8 (Appendix B) presents the current year and historic total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae's ability to grow and reproduce. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

The total phosphorus concentration was **slightly elevated** in **Brown Inlet** and **Russell Inlet** this season. **Brown Inlet** in particular has had a history of **elevated** and **fluctuating** total phosphorus concentrations. We recommend that your monitoring group conduct stream surveys and storm event sampling along this inlet so that we can determine what may be causing the increases.

For a detailed explanation on how to conduct rain event and stream surveys, please refer to the 2002 VLAP Annual Report “Special Topic Article”, or contact the VLAP Coordinator.

➤ **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**

Table 9 (Appendix B) shows the dissolved oxygen/temperature profile(s) for the 2003 sampling season. Table 10 (Appendix B) shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of dissolved oxygen is vital to fish and amphibians in the water column and also to bottom-dwelling organisms. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The dissolved oxygen level was relatively **high in the epilimnion and metalimnion**; however it was **low in the hypolimnion** at the deep spot of the lake. As stratified lakes age, and as the summer progresses, oxygen becomes **depleted** in the hypolimnion (the lower layer) by the process of decomposition. Specifically, the loss of oxygen in the hypolimnion results primarily from the process of biological breakdown of organic matter (i.e.; biological organisms use oxygen to break down organic matter), both in the water column and particularly at the bottom of the lake where the water meets the sediment. When oxygen levels are depleted to less than 1 mg/L in the hypolimnion (**as it was not this season but has been in many past seasons**), the phosphorus that is normally bound up in the sediment may be re-released into the water column.

The **low** oxygen level in the hypolimnion is a sign of the lake’s **aging** and **declining** health.

➤ **Table 11: Turbidity**

Table 11 (Appendix B) lists the current year and historic data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the “Other Monitoring Parameters” section of this report for a more detailed explanation.

The turbidity of the July 29 hypolimnion (lower layer) sample was elevated. This suggests that the lake bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling. When the lake bottom is disturbed, sediment, which typically contains attached phosphorus, is released into the water column. When collecting the hypolimnion sample, please check to make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

The turbidity in **Billings Inlet** and **Brown Inlet** samples were slightly elevated on July 1, which suggests that the stream bottoms may have been disturbed while sampling or that erosion is occurring in this portion of the watershed.

When the stream bottom is disturbed, sediment, which typically contains attached phosphorus, is released into the water column. When collecting samples in the inlets, please be sure to sample where there the stream is flowing and where the stream is deep enough to collect a “clean” sample.

If you suspect that erosion is occurring in this portion of the watershed, we recommend that your monitoring group conduct stream surveys and storm event sampling along this inlet. This additional sampling may allow us to determine what is causing the elevated levels of turbidity.

For a detailed explanation on how to conduct rain event and stream surveys, please refer to the 2002 VLAP Annual Report “Special Topic Article”, or contact the VLAP Coordinator.

➤ **Table 12: Bacteria (*E.coli*)**

Table 12 lists the current year data for bacteria (*E.coli*) testing. *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E.coli* is used as an indicator organism because it is easily cultured and its presence in the water, in defined amounts, indicates that sewage **MAY** be present. If sewage is present in the water, potentially harmful disease-causing organisms may be present. Please consult the “Other Monitoring Parameters” section of the report for the current state standards for *E. coli* in surface waters. If residents are concerned about sources of bacteria such as failing septic systems, animal waste, or waterfowl waste, it is best to conduct *E. coli* testing when the water table is high, when beach use is heavy, or after rain events.

The *E.coli* concentration was **low** at the site tested this season. We hope this trend continues!

DATA QUALITY ASSURANCE AND CONTROL

Annual Assessment Audit:

During the annual visit to your lake, the biologist conducted a “Sampling Procedures Assessment Audit” for your monitoring group. Specifically, the biologist observed the performance of your monitoring group while sampling and filled out an assessment audit sheet to document the ability of the volunteer monitors to follow the proper field sampling procedures (as outlined in the VLAP Monitor’s Field Manual). This assessment is used to identify any aspects of sample collection in which volunteer monitors are not following the proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure that the samples that the volunteer monitors collect are truly representative of actual lake and tributary conditions.

Overall, your monitoring group did an **excellent** job collecting samples on the annual biologist visit this season! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the biologist to provide additional training. Keep up the good work!

Sample Receipt Checklist

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if the volunteer monitors followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, future re-occurrences of improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did a **very good** job when collecting samples this season! Specifically, the members of your monitoring group followed the majority of the proper field sampling procedures when collecting and submitting samples to the laboratory. However, the laboratory did identify one aspect of sample collection that the volunteer monitors could improve upon. It is as follows:

- **Tributary Sampling:** Sediment/debris was observed in the white sample bottle for **Brown Inlet** and **Billings Inlet** on the **July 1** sampling event. Please do not sample tributaries that are too shallow to collect a “clean” sample and do not sample the stream if the stream bottom has been disturbed. You may need to move upstream or downstream to collect a “clean” sample. If you disturb the stream

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bottom while sampling, please rinse out the bottle and move to an upstream location and sample in an undisturbed area.

NOTES

- **Monitor's Note (5/27/03):** Rain past 4 days; water very high.
(7/1/03): Sunny, clear, and calm day, but it has rained in the past 72 hours.
(7/29/03): Spotted 2 loons
(8/26/03): Lake level normal-high.
- **Biologist's Note (7/1/03):** Billings Inlet sample rejected- heavily sedimented, contains plant material. Brown Inlet sample rejected- heavily sedimented. Composite sample appears to be taken with one bottle from the middle of each layer: 3, 6, 10.
(8/26/03): All contents leaked from the white hypolimnion bottle- mouth of bottle is faulty; it has been discarded.

USEFUL RESOURCES

Acid Deposition Impacting New Hampshire's Ecosystems, ARD-32, NHDES Fact Sheet, (603) 271-3505, or www.des.state.nh.us/factsheets/ard/ard-32.htm.

Aquarium Plants and Animals: Don't leave them stranded. Informational pamphlet sponsored by NH Fish and Game, Aquaculture Education and Research Center, and NHDES (603) 271-3505.

Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, NHDES-WD 97-8, NHDES Booklet, (603) 271-3503.

A Boater's Guide to Cleaner Water, NHDES pamphlet, (603) 271-3503.

Camp Road Maintenance Manual: A Guide for Landowners. Kennebec Soil and Water Conservation District, 1992, (207) 287-3901.

Comprehensive Shoreland Protection Act, RSA 483-B, WD-SP-5, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-5.htm.

Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms, NHDES Fact Sheet, (603) 271-3505, or www.des.state.nh.us/factsheets/wmb/wmb-10.htm.

Erosion Control for Construction in the Protected Shoreland Buffer Zone, WD-SP-1, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-1.htm

Impacts of Development Upon Stormwater Runoff, WD-WQE-7, NHDES Fact Sheet, (603) 271-3503, or www.des.state.nh.us/factsheets/wqe/wqe-7.htm

Iron Bacteria in Surface Water, WD-BB-18, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-18.htm

Is it Safe to Eat the Fish We Catch? Mercury and Other Pollutants in Fish, NH Department of Health and Human Services pamphlet, 1-800-852-3345, ext. 4664.

Lake Protection Tips: Some Do's and Don'ts for Maintaining Healthy Lakes, WD-BB-9, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-9.htm.

Management of Canada Geese in Suburban Areas: A Guide to the Basics, Draft Report, NJ Department of Environmental Protection Division of Watershed Management, March 2001, www.state.nj.us/dep/watershedmgt/DOCS/BMP_DOCS/Goosedraft.pdf.

Proper Lawn Care In the Protected Shoreland, The Comprehensive Shoreland Protection Act, WD-SP-2, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-2.htm.

Road Salt and Water Quality, WD-WMB-4, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/wmb/wmb-4.htm.

Sand Dumping - Beach Construction, WD-BB-15, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-15.htm.

Swimmers Itch, WD-BB-2, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-2.htm.

Through the Looking Glass: A Field Guide to Aquatic Plants. North American Lake Management Society, 1988, (608) 233-2836 or www.nalms.org.

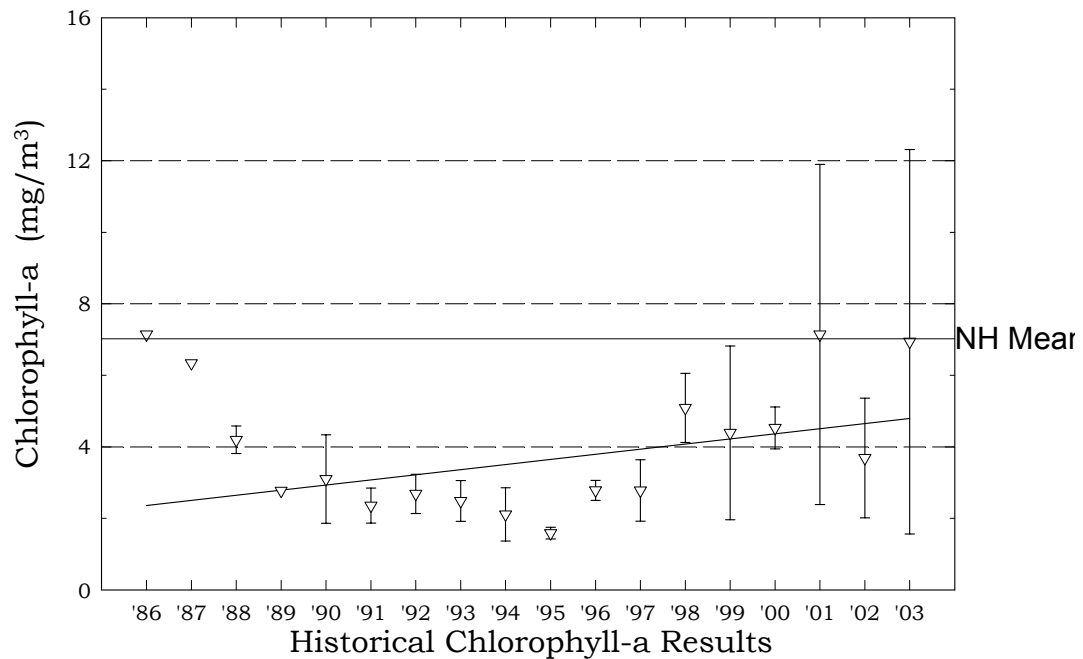
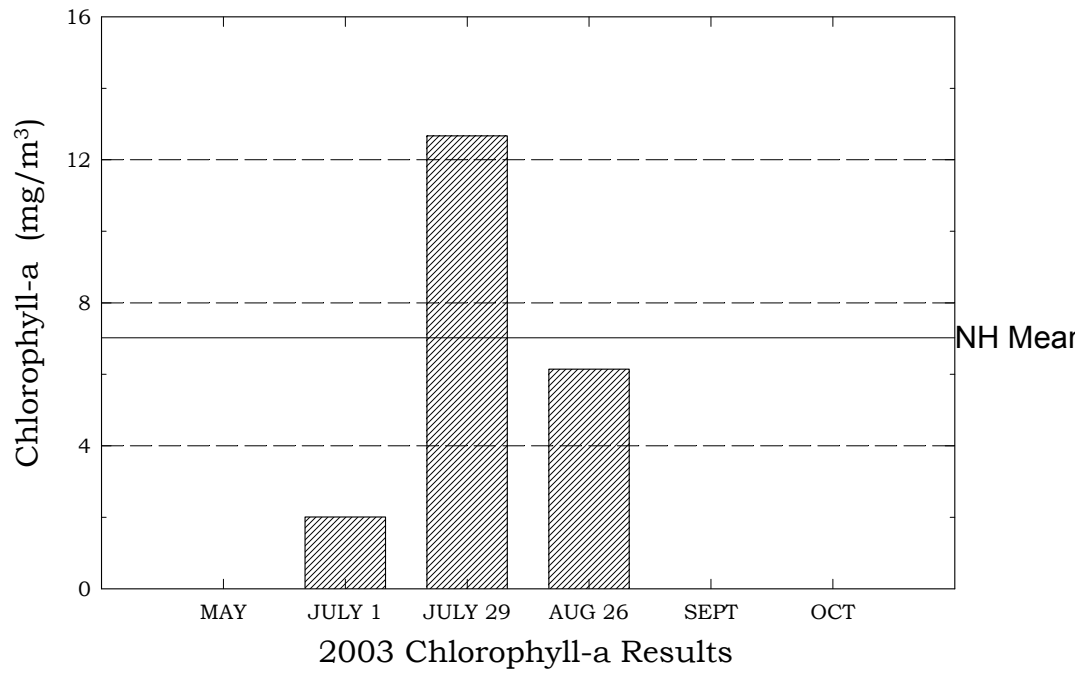
Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants, WD-BB-4, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-4.htm.

APPENDIX A

GRAPHS

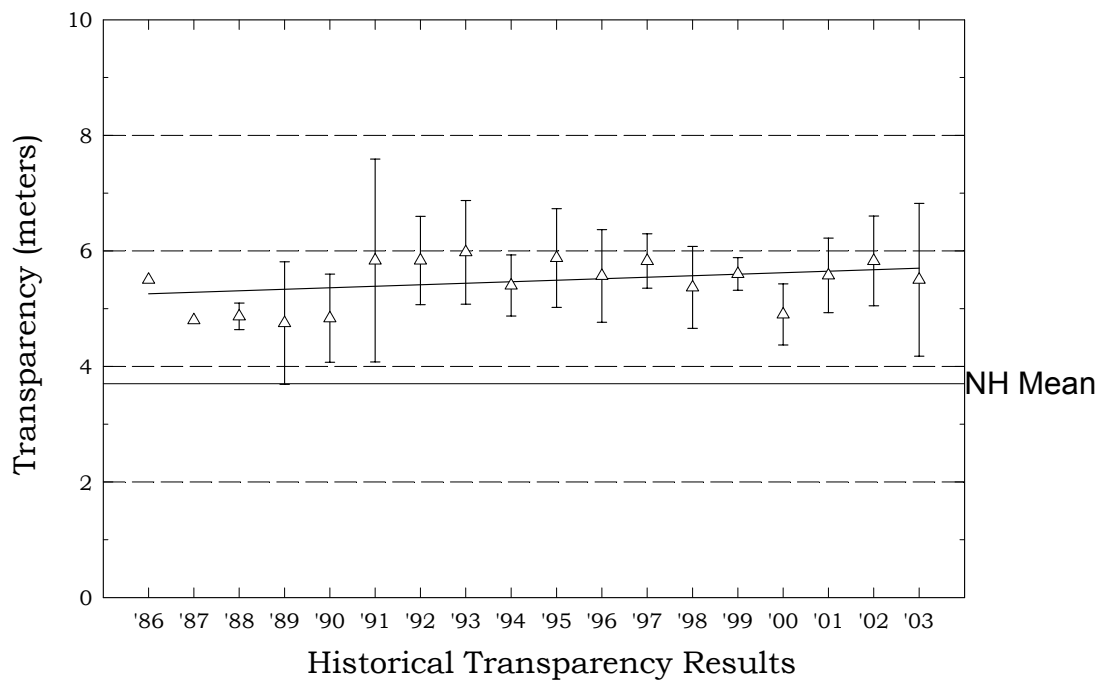
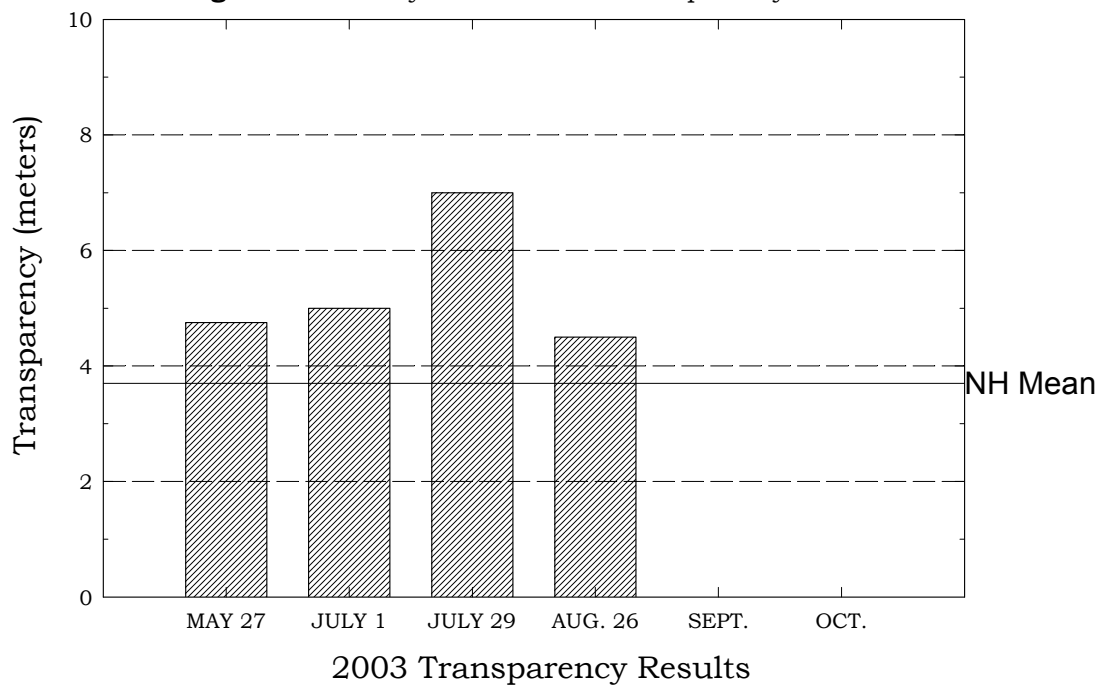
Blaisdell Lake, Sutton

Figure 1. Monthly and Historical Chlorophyll-a Results



Blaisdell Lake, Sutton

Figure 2. Monthly and Historical Transparency Results



Blaisdell Lake, Sutton

Figure 3. Monthly and Historical Total Phosphorus Data.

